Basin Outlook Reports
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How forecasts are made

Most of the annual streamflow in the western United States originates as snowfall that has accumulated in the mountains during the winter and early spring. As the snowpack accumulates, hydrologists estimate the runoff that will occur when it melts. Measurements of snow water equivalent at selected manual snow courses and automated SNOTEL sites, along with precipitation, antecedent streamflow, and indices of the El Niño / Southern Oscillation are used in computerized statistical and simulation models to prepare runoff forecasts. These forecasts are coordinated between hydrologists in the Natural Resources Conservation Service and the National Weather Service. Unless otherwise specified, all forecasts are for flows that would occur naturally without any upstream influences.

Forecasts of any kind, of course, are not perfect. Streamflow forecast uncertainty arises from three primary sources: (1) uncertain knowledge of future weather conditions, (2) uncertainty in the forecasting procedure, and (3) errors in the data. The forecast, therefore, must be interpreted not as a single value but rather as a range of values with specific probabilities of occurrence. The middle of the range is expressed by the 50% exceedance probability forecast, for which there is a 50% chance that the actual flow will be above, and a 50% chance that the actual flow will be below, this value. To describe the expected range around this 50% value, four other forecasts are provided, two smaller values (90% and 70% exceedance probability) and two larger values (30%, and 10% exceedance probability). For example, there is a 90% chance that the actual flow will be more than the 90% exceedance probability forecast. The others can be interpreted similarly.

The wider the spread among these values, the more uncertain the forecast. As the season progresses, forecasts become more accurate, primarily because a greater portion of the future weather conditions become known; this is reflected by a narrowing of the range around the 50% exceedance probability forecast. Users should take this uncertainty into consideration when making operational decisions by selecting forecasts corresponding to the level of risk they are willing to assume about the amount of water to be expected. If users anticipate receiving a lesser supply of water, or if they wish to increase their chances of having an adequate supply of water for their operations, they may want to base their decisions on the 90% or 70% exceedance probability forecasts, or something in between. On the other hand, if users are concerned about receiving too much water (for example, threat of flooding), they may want to base their decisions on the 30% or 10% exceedance probability forecasts, or something in between. Regardless of the forecast value users choose for operations, they should be prepared to deal with either more or less water. (Users should remember that even if the 90% exceedance probability forecast is used, there is still a 10% chance of receiving less than this amount.) By using the exceedance probability information, users can easily determine the chances of receiving more or less water.

IDAHO 2000 SUMMARY AND
FALL WATER SUPPLY OUTLOOK REPORT

NOVEMBER 1, 2000

INTRODUCTION

The Natural Resources Conservation Service has compiled this issue of the Idaho Water Supply Outlook Report to provide water users with information on current conditions going into this winter, what's needed in terms of this year's snowpack and next season's water supply, and a review of last summer's streamflow forecasts.

Contents

GENERAL SUMMARY

In general, the winter weather forecast for the Pacific Northwest is for near normal precipitation and slightly above normal temperatures. The Southern Oscillation Index was more neutral during the summer months but is now +1.0, indicating a moderate La Nina type year may be more likely. The past two years were also La Nina type years.

The dry spring and summer resulted in observed streamflow volumes being less than projected forecasts. The dry conditions also increased irrigation demand, depleting some reservoirs. Reservoir carryover storage is much less than the past two seasons and ranges from 25% of average to normal levels across the state. **Snowpacks and streamflow volumes needed in selected basins to ensure an adequate irrigation supply vary across southern Idaho, but in general range for an April 1 snowpack of 75-100% of average in order to produce the needed streamflow of 60-100% of average.**

Request for Feedback

This is the second time NRCS has written a Fall Summary Outlook Report. If you find the information in this report useful and would like to see this type of report published in future years, please let us know. Contact us by phone, fax, e-mail, or regular mail with your comments or a statement on how you use this information.

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Additional information is available on our Snow Survey Internet page, along with related links to other cooperator's pages: **http://idsnow.id.nrcs.usda.gov/**

WHAT'S NEW IN THE SNOW SURVEY PROGRAM ? !

- *Mid-month or forecasts on demand (Ad Hoc) are now available in Montana and Wyoming.* Following is a page summary of these Ad Hoc forecasts that are available on demand. If you need additional forecasts due to the changing water supply circumstances, please contact us.

- *New streamflow forecasts developed for requesting users that will be published this year:*
  Smith Creek near Bonners Ferry - currently being developed
  Boundary Creek and Moyie River near Bonners Ferry
  Birch Creek near Mud Lake - currently being developed

- *Two new snow courses were located in the Birch Creek basin to assist local water users in their water management needs.* The local irrigation district will measure these sites.

- *Two new SNOTEL sites were installed this summer.* Funding was provided by Idaho State Bureau of Disaster Services. Sites were selected based on need for real time data. Sponsors include Boundary and Latah Soil Conservation Districts, University of Idaho, Nature Conservancy and Smith Creek Hydropower. Thanks for your support!
  Moscow Mountain - replacement for Moscow Mountain snow course near Moscow
  Hidden Lake - replacement for Smith Creek snow course near Bonners Ferry

- *Two SNOTEL sites were moved slightly to improve their data quality.* These sites are **Bogus Basin** and **Schweitzer Basin**. The new locations should allow for less wind effects.

- *Nine new snow depth sensors were installed this summer at these SNOTEL sites: Banner Summit, Bear Basin, Big Creek Summit, Cool Creek, Mountain Meadows, Savage Pass, Trinity Mountain, Hidden Lake and Moscow Mountain.* There are now about 30 SNOTEL sites in Idaho collecting daily or even hourly snow depth data. A new Recreation Report was developed last spring and should be on line in December. Snow depth and Winter Recreation Information is available on our Web page at: http://idsnow.id.nrcs.usda.gov/snow/recreation.html

- *Four SNOTEL sites were removed due to the fires this summer:* No sites were lost due to the Forest Service and other firefighters doing an excellent job in protecting the sites. **Sites removed were Atlanta Summit, Morgan Creek, Moose Creek and Lolo Pass.** These sites have been re-installed and are reporting again. Numerous additional SNOTEL sites were being watched closely in order to protect or remove the equipment in case fires advanced. An assessment on the effects of the fire on water supply is continuing. In general, the lack of forest and canopy may allow the snow to melt sooner and provide additional runoff.

- *Additional work performed at SNOTEL sites this summer, besides regular SNOTEL maintenance, includes:* **replacing four flat snow pillows** - Lookout Pass, Camas Creek, Crater Meadows and Oxford Spring. Three damaged pillows were flat as a result of bear damage. Crater Meadows pillow was replaced via helicopter at an estimated cost of $10,000 after being damaged by a bear three years ago. **Three sites were vandalized** and required additional trips and maintenance - Hams Fork (WY), Schwartz Lake and Howell Canyon.

Summary of Ability to Generate Forecasts on Demand or an Ad Hoc Basis

Why are we Generating Water Supply Forecasts on an Ad Hoc basis?

Production of Ad Hoc water supply forecasts (WSFs) is driven by user needs for more frequent assessments of water supply availability based on real-time SNOTEL information. Users include: NRCS Water Supply Specialists; private, state, and federal reservoir owners/operators; dam safety engineers and hydrologists; Fish and Wildlife organizations; power and utility companies; irrigation companies; and NRCS field offices that distribute our streamflow forecasts to local irrigators, reservoir operators, and conservation district boards.

Where are Ad Hoc Forecasts Available?

Provisional Ad Hoc forecasts are available for evaluation for selected river basins in Montana and Wyoming.

How Often will Ad Hoc Forecasts be Issued?

That is yet to be determined, but mid-month updates of a select number of points will be done initially. When there are "active" weather patterns, it is visualized issuing a weekly WSF update so users can continue to evaluate their risk and make necessary "timely" decisions. Again, these are requested updates. Expansion of this technique to other basins depends on user response to this new product and data network availability.

Do the Ad Hoc Forecasts use Different Procedures?

No. The procedures use the equations (models) that would be used at the beginning of the next month; for example, ad hoc water supply forecasts generated in mid February use the March 1 equations. Projections for snow water equivalent at SNOTEL stations for the remaining portion of the month are made to complete the procedure.

How are SNOTEL Data used in Producing Ad Hoc Forecasts?

Because the WSF procedures selected for this process primarily use SNOTEL data, we can use the current SNOTEL observations and project forward to the 1st of the month. The only "unknown" in these procedures is the next month's SNOTEL snow water equivalent value; the only other data in these procedures (until June 1) is fall precipitation, which is already known. Future equations may also be developed which would use only observed data.

We can simulate the future (or unknown) in several ways. We can simply take the value from SNOTEL today and use it as is, thus assuming no additional accumulation. Alternatively, we could add to it some portion of a normal (average) increment. For example, if we think the precipitation during the remaining period of the month is going to be below normal, then we could add, say, 75% of a normal increase (prorated for the days left until the first of the month) to the current observed value. Likewise, we could add, say, 125% of the normal increase if we saw that the weather forecasts called for major storms in the coming days or weeks. Another option is to use the same rate of change that has occurred so far this month. For example, if the February 1 snow water equivalent was 10" and the value on February 22 was 12" that is a 2" increase over the first 22 days of the month, or 2/22 = or 0.0909" per day. The process would then add 0.0909 * 7 (days left in the month [leap year]) = 0.6 to obtain 12.6" as the estimated value for March 1.

Are Ad Hoc Forecasts Reliable?

Because the ad hoc forecasts use the same data sites and equations as for the 1st-of-month forecasts, they should be of comparable reliability to the regular forecasts. Most of the 1st-of-month equations were updated in 1998 or 1999 and were typically based on data from 1961 through 1997 or 1998. These equations are statistically significant and hydrologically sound. Considerable effort was made to use the same data sites from month to month to ensure stability in the forecasts throughout the season and to use only stations that are located in, or on the boundary of, the basin. A comparison of the standard errors of these equations with those of previous equation sets along with professional experience in this area suggest that these procedures are better than most sets that have been used in recent years.

How does this Procedure Affect WSF Probability Values?

The projection of snow water equivalent values from the current day to the beginning of the next month introduces an additional source of error to the already known equation error; the magnitude of this additional error depends on the number of days remaining in the month. Until we can develop the necessary software, we will initially use the forecast uncertainty for the applicable 1st-of-month equations, even though this is not strictly correct. Therefore, for now, users should assume a bit more variation in WSF values than the probability levels shown. We are currently examining methods to pro-rate the standard errors of the monthly forecast equations into the Ad Hoc process.

Are the Ad Hoc Forecasts Reviewed and/or Coordinated?

The NWCC Forecast Hydrologists go through the same review process with the appropriate Water Supply Specialists as they would do on the 1st of the month. We are currently not "coordinating" these provisional numbers with the National Weather Service River Forecast Centers; support for this endeavor, however, has come from the Missouri Basin River Forecast Center, where most of the points are located. With only a couple of exceptions, NRCS has primary responsibility for all of the points where ad hoc forecasts are being generated.

Are the forecasts available via the Internet?

Yes. The official link is on the Montana NRCS home page. There is both a text-based product and a graphical product. All of the users for whom we have developed these forecasts have been contacted as to where to find the latest updates.

SUMMER 2000 PRECIPITATION

Spring precipitation is the last unknown piece in the water supply picture. As we have seen in recent years, spring precipitation can make or break a streamflow forecast. Near record dry summer precipitation resulted in observed streamflow volumes being less than projected forecasts.

A dry summer in Idaho is not unusual, but, March-July precipitation totals were at record or near record low levels. Nearly all high elevation SNOTEL sites south of the Clearwater Basin reported March-July precipitation within the top 5 driest years since the sites were installed 18 years ago. The National Weather Service station in Malad City, Oneida County, recorded the driest March-July period since the station started 54 years ago. Hollister in Twin Falls County recorded the fifth driest March-July period out of 82 years; years receiving less precipitation than this summer were 1919, 1920, 1924, and 1933.

The beginning of this drought may have actually started last July after the cool wet spring melted the snow later than normal. Last year's dry summer and fall created soil moisture deficits across the southern half of Idaho. After a late winter start, the snow finally came and peaked at 80 to 100 percent of normal in March. Idaho's dry spring compounded with last fall's dry weather quickly absorbed the melt water from the snow. Snowmelt occurred a month early, allowing streams to peak nearly a month early as well.

Besides adding to the dry forest fire conditions, the hot dry summer increased irrigation demand and depleted some reservoirs by summer's end.

Water Year 2000 SNOTEL Precipitation Summary

Region / Basin	*Precipitation as Percent of Average for Oct. 1, 1999 - Sept. 30, 2000*
IDAHO PANHANDLE REGION	102
CLEARWATER	96
SALMON	86
WEISER, PAYETTE & BOISE	89
WOOD & LOST	83
UPPER SNAKE RIVER	77
SOUTHSIDE SNAKE RIVER	78
BEAR RIVER	76

FALL PRECIPITATION / SNOWPACK SUMMARY

Several storms systems moved through the state in September and October helped extinguish fires and returned much needed moisture to the soil profile. September mountain precipitation ranged from 110-190% of average in the central and northern parts of the state and was about 75% of average in the upper Snake and basins south of the Snake River. October brought more precipitation especially across central Idaho. Boise set a new record for the amount of precipitation received in October, 2.59 inches. SNOTEL sites in the Boise and Big Wood basins received the highest amounts (3-6 inches of precipitation, 200-300% of average). These were not record October totals but were the 2nd or 3rd highest for the 18 year SNOTEL precipitation period of record.

The fall moisture helped recharge the soil moisture profile throughout the state. The storms brought snow to the higher elevations and melted in some areas while north-facing slopes retained the snow. As of November 1, snow water equivalents amounts ranged from 1-3 inches with the highest amounts across the central mountains. On average most Idaho SNOTEL measuring stations start accumulating snow around November 1. **Average November 1 snow water content in Idaho ranges from 0 to 2.5 inches.**

RESERVOIR CARRYOVER STORAGE

Good reservoir carryover storage from last year provided additional water supplies for Idaho's numerous water users. However, some reservoirs were depleted by summer's end. Carryover storage is much lower than the past two seasons and will not provide that added insurance level as it has in the past. Salmon Falls Reservoir and Mackay reservoirs are currently the lowest in the state at about 25% of average, or 7% of capacity. Other reservoirs vary and range from 40% of average to near normal storage levels.

Note: NRCS reports reservoir information in terms of usable volumes, which includes both active, inactive, and in some cases dead storage. Other operators may report reservoir contents in different terms. For additional information, see the reservoir definitions in the back of this report.

BARE - DATA CURRENT AS OF:11/06/00
From Idaho Web page: http://idsnow.id.nrcs.usda.gov/snow/rsi.htm

IDAHO BASIN WIDE RESERVOIR SUMMARY

FOR THE END OF OCTOBER 2000

BASIN AREA **RESERVOIR**	**CURRENT AS** **% CAPACITY**	LAST YR AS % CAPACITY	AVERAGE AS % CAPACITY	**CURRENT AS** **% AVERAGE**	CURRENT AS % LAST YR
PANHANDLE REGION					
HUNGRY HORSE	81	88	84	96	93
FLATHEAD LAKE	89	98	90	98	90
NOXON RAPIDS	96	96	95	101	100
PEND OREILLE	57	59	63	90	97
COEUR D'ALENE	53	59	66	81	89
PRIEST LAKE	74	84	67	109	88
TOTAL OF 6 RESERVOIRS	78	84	81	96	93
CLEARWATER RIVER BASIN					
DWORSHAK	64	64	78	82	100
TOTAL OF 1 RESERVOIRS	64	64	78	82	100
WEISER, PAYETTE, BOISE RIVER BASINS					
MANN CREEK	5	5	22	21	83
CASCADE	57	72	59	98	79
DEADWOOD	57	69	39	147	83
ANDERSON RANCH	61	72	71	86	84
ARROWROCK	14	24	[illegible]8	51	61
LUCKY PEAK	29	31	26	113	95
LAKE LOWELL (DEER FLAT)	56	60	59	95	95
TOTAL OF 7 RESERVOIRS	48	58	51	94	82
WOOD AND LOST RIVER BASINS					
MAGIC	16	45	36	45	36
LITTLE WOOD	11	25	27	43	45
MACKAY	8	36	31	25	21
TOTAL OF 3 RESERVOIRS	14	41	34	42	34
UPPER SNAKE RIVER BASIN					
HENRYS LAKE	91	95	82	111	96
ISLAND PARK	61	86	50	123	71
GRASSY LAKE	81	78	64	127	103
JACKSON LAKE	76	74	53	142	102
PALISADES	30	79	69	43	37
RIRIE	52	50	41	127	104
BLACKFOOT	52	73	61	85	71
AMERICAN FALLS	16	45	35	46	37
TOTAL OF 8 RESERVOIRS	38	65	52	72	58
SOUTHSIDE SNAKE RIVER BASINS					
OAKLEY	24	42	25	95	57
SALMON FALLS	6	28	23	26	22
WILDHORSE RESERVOIR	48	64	41	117	75
OWYHEE	30	54	51	59	55
BROWNLEE	79	66	97	81	119
TOTAL OF 5 RESERVOIRS	57	59	75	76	96
BEAR RIVER BASIN					
BEAR LAKE	60	83	71	84	72
MONTPELIER CREEK	20	70	40	50	29
TOTAL OF 2 RESERVOIRS	60	83	71	84	72

AMOUNTS NEEDED FOR ADEQUATE WATER SUPPLIES FOR NEXT SUMMER

The amount of water required for next summer's irrigation season vary depending upon demand and reservoir storage. Following is a table summarizing current reservoir storage, projected reservoir storage, streamflow volume needed and maximum snowpack that has historically produced this amount. This analysis is an attempt to quantify for users the amount needed in each basin where shortages occasionally occur. These projections are based on the Idaho Surface Water Supply Index (SWSI) and snow indexes. Additional information about these indexes is available on our Internet Web page at: http://idsnow.id.nrcs.usda.gov/snow/water.htm and ftp://idsnow.id.nrcs.usda.gov/pub/data/indexes/

Assumptions and definitions in table: Projected reservoir storage levels are based upon average change in reservoir and/or a regression equation. Required streamflow volume for adequate irrigation supply is determined from the SWSI tables. The snowpack percent of average that is needed to produce this streamflow volume is determined from the historic data record. In most basins the record starts in 1961. The snowpack percent of average is the maximum snowpack that resulted in the given streamflow volume. Note: there have been years with a smaller April 1 snowpack percentage that resulted in greater runoff volumes. The snowpack percentages in this table reflect the highest percentage historically that produced the given volume.

Basin / Reservoir	Current Reservoir Storage Oct. 31, 2000 (1000 AF)	Projected Reservoir Storage (1000 AF, Date)	Streamflow Needed For Adequate Irrigation Water Supply (1000 Acre-feet (% of avg)) Period	Minimum snowpack % of average that has always produced the volume needed in the previous column. (% of avg (Date))
Boise 3 Reservoirs	409.7	570 Mar 31	>1000 KAF (65% of avg) Apr-Sep	>90% of avg on Apr 1
Big Wood Magic	30.9 KAF	70-80 KAF Mar 31	>200 KAF (65% of avg) Apr-Sep	>85% of avg on Apr 1
Little Wood	3.4 KAF	12 KAF Mar 31	>60 KAF(60% of avg) Apr-Sep	>82% of avg on Apr 1
Big Lost Mackay	3.4	22 KAF Mar 31	>150-180 KAF (~95% of avg) Apr-Sep	>100% of avg on Apr 1
Henrys Fork & Mainstem Snake River	8 reservoirs are 32% of capacity, 72% of avg		Due to complexity of reservoir operations, it is difficult to estimate amount needed - shortages occur less than 10% of the time in the Henrys Fork and less than 25% of the time for the Mainstem Snake River users.	
Goose Oakley	17.9	30 KAF	>20 KAF (55% of avg) Mar-Sep	>75%of avg on Mar 1
Salmon Falls	11.1 KAF	23 KAF Feb 28	>90 KAF (94% of avg) Mar-Sep	>90% of avg on Mar 1
Bear Bear Lake	851.4 KAF	850 KAF	Based on present storage level, water supplies should be adequate for Bear Lake water users.	
Owyhee	215.7 KAF	300 KAF Feb 28	>170 KAF (25% of avg) Feb-Sep	10-80% of avg on Mar 1 - Varies and depends on spring precipitation.

LA NINA - EL NINO - SOUTHERN OSCILLATION INDEX INFORMATION

The El Nino-Southern Oscillation (ENSO) is a coupled ocean-atmosphere phenomenon, each component receiving feedback from, and influencing, the other. The El Nino is the oceanic component in which the sea surface temperatures are warmer than average in the eastern Pacific. Its counterpart, where sea surface temperatures are colder than average, is called La Nina. The Southern Oscillation is the associated atmospheric component in which higher and lower than average barometric pressures swing back and forth between the far western Pacific and locations to the east in the south Pacific.

A convenient index to the ENSO is the Southern Oscillation Index (SOI). This index measures the barometric pressure difference between Darwin, Australia and Tahiti and indicates the status of the atmospheric component of the ENSO. Several studies have found modest but significant statistical relationships between the SOI and precipitation, temperature, and streamflow in the West. Of particular importance in forecasting, the signal from the SOI precedes the effects in the western US by up to six months, giving forecasters the opportunity to utilize this information well in advance of the traditional start of the streamflow forecasting season in January (in many cases as early as October and November).

After two consecutive La Nina-type years, the SOI index was near zero this summer, which was indicating that neither El Nino nor La Nina would be providing a strong influence on the overall precipitation and temperature across Idaho for the coming winter. However, the SOI increased in late summer and has been steady the past two months at +1.0. This indicates a moderate La Nina-type winter may be more likely.

Current Southern Oscillation Index Values

The standardized SOI for the past several months:

June	July	August	September	October
-0.6	-0.4	0.4	+1.0	+1.0

Recent studies have shown that La Nina years (like last year) are generally wetter and a little cooler in Idaho, especially in the mountains, than neutral years (years with the SOI around zero). There also is a greater tendency for heavy precipitation days (days with precipitation above the 90th percentile value for each day) and large streamflow days to occur in La Nina winters and springs than in neutral years. Thus a SOI value near +1.0, where it is now, would be more likely to produce slightly more days with precipitation, as well as more days with large streamflow volumes, compared to years when the SOI is neutral or negative (Other La Nina years: 1999, 1989, 1976 and 1956).

After a summer of fires that burned nearly 1.3 millions acres in Idaho, the last type of winter Idaho needs is one associated with much above normal precipitation (numerous storms) and potential rain-on-snow events. Long range forecasts for Idaho call for near normal precipitation and slightly above normal temperatures this winter. Of course, exceptions do occur, such as the very wet 1997 water year, which was a near neutral to slight La Nina year. We'll keep our fingers crossed for an adequate snowpack to meet Idaho's numerous water needs and a moderate melt in the low and high elevations to reduce potential erosion and protect the soil in burned areas. The SNOTEL Network will play a critical role this winter in providing real time remote weather data from Idaho mountains. Additional information about ENSO and its correlation with Idaho's winter precipitation and streamflow is available on our Internet Web page at this location: http://idsnow.id.nrcs.usda.gov/snow/water.htm

American Meteorological Society, 1999 by Dan Cayan, Kelly Redmond and Laurence Riddle, "ENSO And Hydrologic Extremes In The Western U.S.", and
Water Resources Research Sept. 1991,by Kelly Redmond and Roy Koch in 1991, "Surface Climate and Streamflow Variability in the Western U.S. and Their Relationship to Large-Scale Circulation Indices"

EARLY SEASONAL STREAMFLOW VOLUME FORECASTS BASED ON EL NINO / SOUTHERN OSCILLATION (ENSO)

Early streamflow forecasts in certain areas for next spring and summer are possible based on knowledge of ENSO. Since this phenomenon can have major impacts on weather patterns in the western United States (and elsewhere), it is prudent to be prepared as far in advance as possible for its likely climatological and hydrological impacts.

These early season streamflow forecasts in this report are based primarily on the SOI. The skill of these forecasts, as reflected in the spread of values for the various exceedance probabilities, is modest when compared with that of traditional forecasts based on snow measurements. Nevertheless, these SOI-based forecasts do contain valuable information, made all the more important by how early in the season they can be produced. As with all streamflow forecasts, these must be viewed not as single values, but as a range of values, each with a specific probability of occurrence. The spread of values will diminish with each new forecast as winter progresses. For operational decisions, users should select forecasts corresponding to the level of risk they are willing to assume about the amount of water to be expected.

Summary: November forecasts for next season's runoff are projected at normal to slightly above normal volumes based primarily on the correlation with SOI. The 'r' correlation coefficient ranges from 0.40 for the Spokane, White Bird and Snake equations to 0.66 for the Dworshak Reservoir Inflow forecast. In comparison the 'r' correlation is in the 0.90 to 0.95 for most April 1 forecasts.

forecasts categorically (e.g. instead of issuing a forecast of 77 percent of average, the forecast would simply be 'below average'. Specifically the categories are:

- Much below average (less than 70 percent of average)
- Below average (70 - 89 percent of average)
- Near average (90 - 110 percent of average)
- Above average (111 - 130 percent of average)
- Much above average (greater than 130 percent of average)

In summary, because of decreased specificity, categorical forecasts will allow the hydrologist to optionally continue forecasts for streamflow points with no observations.

REVIEW OF THE 2000 STREAMFLOW FORECASTS VERSUS OBSERVED STREAMFLOW

How well did the streamflow forecasts perform last year? The following table is a comparison of the actual 2000 April-July streamflow volumes (based on provisional data) and the 5 Exceedance Forecasts for each month. Stations were selected based upon data availability and to represent basins across the state.

In general, forecasts were near the 50% Chance of Exceeding in the Panhandle Region. Forecasts for southern Idaho streams generally fell in the 90% to 50% Chance of Exceeding range due to below normal and near record low precipitation during the critical snowmelt period. The occurrence of observed runoff in the tail of the probability distribution is a result of the unusually dry and lack of spring moisture. The **boxed or bold line** in the right-hand columns show where the observed flows fell when compared to the forecast probability distribution.

This year is the opposite of spring 1997 when record high precipitation amounts fell during the critical snowmelt time resulting in flooding and extended high flows in the upper Snake and generating runoff volumes greater than the 30% and 10% Chance of Exceeding Forecasts. **Users need to review all five corresponding forecasts to determine the level of risk they are willing to assume and adjust their operations accordingly.**

Review of the 2000 Streamflow Forecasts Versus Observed Streamflow

Note: boxed value or bold line shows where forecast fell on probability distribution.

Basin / Forecast Point Forecast Period	Forecast Month	Most Probable Forecast (% of avg)	Observed Flow (% of avg)	1961-1990 Average Flow (KAF)	Probability distribution of forecast as a percent of average: 90%	70%	50%	30%	10%
Panhandle Region									
Priest near Priest River									
apr-jul	jan	104	112	812	84	96	104	112	124
apr-jul	feb	113	112	812	98	107	113	120	129
apr-jul	mar	111	112	812	98	105	111	116	124
apr-jul	apr	110	112	812	97	105	110	115	[illegible]
may-jul	may	102	102	626	88	96	102	107	[illegible]
jun-jul	jun	106	97	297	86	98	106	114	126
Coeur d'Alene at Enaville									
apr-jul	jan	105	111	769	84	97	105	113	126
apr-jul	feb	113	111	769	97	107	113	120	129
apr-jul	mar	108	111	769	94	103	108	114	122
apr-jul	apr	104	111	769	91	99	104	109	117
may-jul	may	86	78	472	68	79	86	94	105
jun-jul	jun	88	80	166	52	73	88	103	124
St. Joe at Calder									
apr-jul	jan	107	101	1169	81	96	107	118	133
apr-jul	feb	104	101	1169	85	96	104	112	123
apr-jul	mar	101	101	1169	83	94	101	108	119
apr-jul	apr	94	101	1169	80	88	94	100	109
may-jul	may	80	83	881	64	74	80	86	96
jun-jul	jun	75	75	397	54	67	75	83	96
Clearwater Basin									
Dworshak Resv Inflow									
apr-jul	jan	104	102	2687	76	93	104	116	132
apr-jul	feb	104	102	2687	82	95	104	113	126
apr-jul	mar	104	102	2687	86	97	104	112	123
apr-jul	apr	99	102	2687	83	93	99	106	115
may-jul	may	79	88	2028	61	72	79	87	97
jun-jul	jun	73	78	1002	49	63	73	83	97
Clearwater at Orofino									
apr-jul	jan	100	85	4729	75	90	100	109	124
apr-jul	feb	105	85	4729	88	98	105	112	122
apr-jul	mar	105	85	4729	89	99	105	112	121
apr-jul	apr	96	85	4729	84	91	96	102	109
may-jul	may	86	75	3826	73	81	86	91	99
jun-jul	jun	74	62	2052	54	66	74	82	93
Salmon Basin									
Salmon at Salmon									
apr-jul	jan	87	70	869	58	75	87	99	116
apr-jul	feb	93	70	869	70	84	93	102	115
apr-jul	mar	96	70	869	76	88	96	103	115
apr-jul	apr	90	70	869	75	84	90	96	105
may-jul	may	76	64	772	64	71	76	81	88
jun-jul	jun	67	50	541	59	64	67	70	74

		Most			Note: boxed value or bold line shows where forecast fell on probability distribution.				
		Probable	Observed	1961-1990	Probability distribution of forecast				
Basin / Forecast Point	Forecast	Forecast	Flow	Average	as a percent of average				
Forecast Period	Month	(% of avg)	(% of avg)	(KAF)	90%	70%	50%	30%	10%
Weiser, Payette & Boise Basins									
Weiser near Weiser									
feb-jul	jan	**92**	**105**	613	47	74	**92**	111	138
feb-jul	feb	**86**	**105**	613	43	69	**86**	104	129
mar-jul	mar	**107**	**88**	525	71	92	**107**	121	142
apr-jul	apr	**98**	**81**	386	65	85	**98**	112	132
may-jul	may	**86**	66	250	54	73	**86**	99	118
jun-jul	jun	76	**54**	112	46	64	76	88	106
SF Payette at Lowman									
apr-jul	jan	**81**	**79**	432	[illegible]	68	**81**	95	114
apr-jul	feb	**87**	**79**	432	63	77	**87**	96	110
apr-jul	mar	**97**	**79**	432	79	90	**97**	104	114
apr-jul	apr	**92**	**79**	432	78	87	**92**	98	106
may-jul	may	**77**	71	375	65	72	77	81	88
jun-jul	jun	**67**	57	245	55	62	67	71	78
NF Payette at Cascade									
apr-jul	jan	92	**70**	496	59	78	**92**	105	125
apr-jul	feb	100	**70**	496	74	89	**100**	110	126
apr-jul	mar	**104**	**70**	496	82	95	**104**	113	126
apr-jul	apr	99	**70**	496	81	92	**99**	107	117
may-jul	may	**81**	**68**	407	63	74	**81**	88	99
jun-jul	jun	**80**	**92**	230	47	66	**80**	94	113
Boise near Twin Springs									
apr-jul	jan	**76**	**85**	631	46	64	76	88	106
apr-jul	feb	**83**	**85**	631	61	74	**83**	92	104
apr-jul	mar	**90**	**85**	631	72	82	**90**	97	107
apr-jul	apr	**87**	**85**	631	75	82	**87**	92	100
may-jul	may	**72**	**72**	509	59	67	72	77	85
jun-jul	jun	**65**	**59**	286	48	58	**65**	72	82
SF Boise at Anderson Ranch									
apr-jul	jan	**63**	**70**	544	30	50	**63**	77	97
apr-jul	feb	**73**	**70**	544	47	62	**73**	83	98
apr-jul	mar	**85**	**70**	544	63	76	**85**	93	106
apr-jul	apr	**77**	**70**	544	65	72	**77**	82	89
may-jul	may	**70**	**59**	432	53	63	**70**	77	87
jun-jul	jun	**59**	**47**	227	43	52	**59**	65	74
Wood & Lost River Basins									
Big Wood at Hailey									
apr-jul	jan	**55**	66	255	18	40	**55**	70	92
apr-jul	feb	**58**	66	255	30	47	**58**	69	86
apr-jul	mar	**73**	**66**	255	52	64	**73**	82	97
apr-jul	apr	**73**	**66**	255	57	66	**73**	80	90
may-jul	may	**52**	**60**	224	41	47	**52**	56	64
jun-jul	jun	**48**	**49**	143	32	41	**48**	55	66
Little Wood near Carey									
apr-jul	jan	**46**	**53**	92	0	23	**46**	69	103
apr-jul	feb	**62**	**53**	92	24	47	**62**	77	99
apr-jul	mar	**75**	**53**	92	39	60	**75**	90	111
apr-jul	apr	**70**	**53**	92	47	60	**70**	79	93
may-jul	may	**59**	**46**	65	32	48	**59**	71	87
jun-jul	jun	**55**	**37**	34	20	41	**55**	69	90

		Most			Note: boxed value or bold line shows where forecast fell on probability distribution.				
		Probable	Observed	1961-1990	**Probability distribution of forecast**				
Basin / Forecast Point	Forecast	Forecast	Flow	Average	**as a percent of average**				
Forecast Period	Month	(% of avg)	(% of avg)	(KAF)	90%	70%	**50%**	30%	10%
Upper Snake River Basin									
Jackson Lake Inflow									
apr-jul	jan	**81**	68	782	60	72	**81**	89	101
apr-jul	feb	**81**	**68**	782	64	74	**81**	88	98
apr-jul	mar	**85**	**68**	782	69	78	**85**	91	100
apr-jul	apr	**88**	**68**	782	76	83	**88**	92	100
may-jul	may	**79**	**69**	726	67	74	**79**	84	92
jun-jul	jun	**71**	**64**	491	49	62	**71**	80	94
Salt near Etna									
apr-jul	jan	**71**	**68**	319	34	56	**71**	85	107
apr-jul	feb	**76**	**68**	319	46	64	**76**	88	106
apr-jul	mar	**81**	**68**	319	52	69	**81**	92	109
apr-jul	apr	**80**	**68**	319	59	71	**80**	88	101
may-jul	may	**60**	**60**	260	38	51	**60**	69	82
jun-jul	jun	**53**	**52**	148	26	42	**53**	64	81
Greys near Alpine									
apr-jul	jan	**71**	**85**	333	40	58	**71**	83	101
apr-jul	feb	**75**	**85**	333	52	66	**75**	85	98
apr-jul	mar	**80**	**85**	333	60	72	**80**	88	100
apr-jul	apr	**81**	**85**	333	67	75	**81**	87	96
may-jul	may	**67**	**78**	295	55	62	**67**	72	79
jun-jul	jun	**58**	**65**	187	40	51	**58**	66	77
Henrys Fork near Ashton									
apr-jul	jan	**88**	**92**	544	71	82	**88**	95	106
apr-jul	feb	[illegible]	**92**	544	69	79	**86**	92	102
apr-jul	mar	[illegible]	**92**	544	81	90	**96**	102	111
apr-jul	apr	**92**	**92**	544	78	86	**92**	98	106
may-jul	may	**87**	**82**	432	70	80	**87**	94	104
jun-jul	jun	**82**	**82**	239	64	75	**82**	89	100
Falls near Squirrel									
apr-jul	jan	**85**	**87**	364	67	78	**85**	93	103
apr-jul	feb	**89**	**87**	364	72	82	**89**	96	106
apr-jul	mar	**95**	**87**	364	78	88	**95**	101	111
apr-jul	apr	**95**	**87**	364	81	89	**95**	100	109
may-jul	may	**87**	**80**	322	71	81	**87**	93	103
jun-jul	jun	**61**	**51**	266	44	54	**61**	67	77
Teton near Driggs									
apr-jul	jan	**86**	**71**	152	52	72	**86**	99	119
apr-jul	feb	**94**	**71**	152	63	81	**94**	107	125
apr-jul	mar	**104**	**71**	152	75	92	**104**	116	133
apr-jul	apr	**102**	**71**	152	80	93	**102**	111	124
may-jul	may	**88**	**70**	130	69	81	**88**	96	108
jun-jul	jun	**82**	**65**	99	66	76	**82**	89	98

Basin / Forecast Point Forecast Period	Forecast Month	Most Probable Forecast (% of avg)	Observed Flow (% of avg)	1961-1990 Average (KAF)	90%	70%	50%	30%	10%
					Note: boxed value or bold line shows where forecast fell on probability distribution. Probability distribution of forecast as a percent of average				
Southside Snake River Basins									
Salmon Falls near San Jacinto									
mar-jul	jan	**56**	**50**	91.3	28	44	56	70	94
mar-jul	feb	**70**	**50**	91.3	40	57	70	84	108
mar-jul	mar	**74**	**50**	91.3	48	63	74	86	106
apr-jul	apr	**68**	**49**	79.4	43	57	68	80	99
may-jul	may	**40**	**37**	56.8	23	33	40	49	63
jun-jul	jun	**32**	**25**	24.8	19	27	32	38	48
Bruneau near Hot Springs									
mar-jul	jan	**55**	**47**	235	29	44	55	68	90
mar-jul	feb	**60**	**47**	235	35	49	60	72	92
mar-jul	mar	**75**	**47**	235	47	63	75	88	109
apr-jul	apr	**70**	**46**	209	43	58	70	83	103
may-jul	may	**53**	**38**	162	31	43	53	64	81
jun-jul	jun	**42**	**29**	82.1	20	32	42	53	72
Owyhee near Gold Creek									
mar-jul	jan	**44**	**48**	31.4	0	25	44	63	90
mar-jul	feb	**53**	**48**	31.4	21	38	53	70	99
mar-jul	mar	**76**	**48**	31.4	43	62	76	93	120
apr-jul	apr	**84**	**48**	25.1	43	66	84	104	137
may-jul	may	**29**	**8**	12.2	2	14	29	49	89
jun-jul	jun	**23**	**0**	2.21	0	4	23	57	136
Owyhee near Rome									
feb-jul	jan	**46**	**46**	622	13	30	46	65	98
feb-jul	feb	**48**	**46**	622	21	36	48	63	87
mar-jul	mar	**67**	**45**	545	45	57	67	77	93
apr-jul	apr	**103**	**39**	377	75	91	103	116	135
may-jul	may	**31**	**23**	200	9	21	31	43	65
jun-jul	jun	**36**	**24**	77.9	19	28	36	44	58
Owyhee Reservoir Inflow									
feb-jul	jan	**42**	**49**	567	16	30	42	56	81
feb-jul	feb	**49**	**49**	567	25	38	49	62	82
mar-jul	mar	**71**	**49**	567	48	61	71	81	98
apr-jul	apr	**103**	**45**	390	71	89	103	117	139
may-jul	may	**36**	**36**	210	23	30	36	43	53
jun-jul	jun	**37**	**47**	85.1	18	29	37	47	63

Interpreting Streamflow Forecasts

Introduction
Each month, five forecasts are issued for each forecast point and each forecast period. Unless otherwise specified, all streamflovv forecasts are for streamflow volumes that would occur naturally without any upstream influences. Water users need to know what the different forecasts represent if they are to use the information correctly when making operational decisions. The following is an explanation of each of the forecasts.

Most Probable (50 Percent Chance of Exceeding) Forecast. This forecast is the best estimate of streamflow volume that can be produced given current conditions and based on the outcome of similar past situations, There is a 50 percent chance that the streamflow volume will exceed this forecast value. There is a 50 percent chance that the streamflow volume will be less than this forecast value.

The most probable forecast will rarely be exactly right, due to errors resulting from future weather conditions and the forecast equation itself. This does not mean that users should not use the most probable forecast; it means that they need to evaluate existing circumstances and determine the amount of risk they are willing to take by accepting this forecast value.

To Decrease the Chance of Having Too Little Water
If users want to make sure there is enough water available for their operations, they might determine that a 50 percent chance of the streamflow volume being lower than the most probable forecast is too much risk to take. To reduce the risk of not having enough water available during the forecast period, users can base their operational decisions on one of the forecasts with a greater chance of being exceeded (or possibly some point in-between). These include:

70 Percent Chance of Exceeding Forecast. There is a 70 percent chance that the streamflow volume will exceed this forecast value.
There is a 30 percent chance the streamflow volume will be less than this forecast value.
90 Percent Chance of Exceeding Forecast. There is a 90 percent chance that the streamflow volume will exceed this forecast value.
There is a 10 percent chance the streamflow volume will be less than this forecast value.

To Decrease the Chance of Having Too Much Water
If users want to make sure they don't have too much water, they might determine that a 50 percent chance of the streamflow being higher than the most probable forecast is too much of a risk to take. To reduce the risk of having too much water available during the forecast period, users can base their operational decisions on one of the forecasts with a smaller chance of being exceeded. These include:

30 Percent Chance of Exceeding Forecast. There is a 30 percent chance that the streamflow volume will exceed this forecast value. There is a 70 percent chance the streamflow volume will be less than this forecast value.
10 Percent Chance of Exceeding Forecast. there is a 10 percent chance that the streamflow volume will exceed this forecast value. There is a 90 percent chance the streamflow volume will be less than this forecast value.

Using the forecasts - an example

Using the Most Probable Forecast. Using the example forecasts shown below, users can reasonably expect 36,000 acre-feet to flow past the gaging station on the Mary's River near Death between March I and July 31.

Using the Higher Exceedence Forecasts. If users anticipate a somewhat drier trend in the future (monthly and seasonal weather outlooks are **available** from the **National** Weather Service every two weeks), or if **they are** operating **at a level** where an unexpected shortage of water could cause problems, they might want to plan on receiving only 20,000 acre-feet (from the 70 percent chance of exceeding forecast). In seven out of ten years with similar conditions, streamflow volumes will exceed the 20,000 acre-foot forecast.

If users anticipate extremely dry conditions for the remainder of the season, or if they determine the risk of using the 70 percent chance of cxceeding forecast is too great, then they might plan on receiving only 5000 acre-feet (from the **90** percent chance of exceeding forecast). Nine out of ten years with similar conditions, streamflow volumes will exceed the 5000 acre-foot forecast.

Using the Lower Exceedance Forecasts. If users expect wetter future conditions, or if the chance that five out of every ten years with similar conditions would produce streamflow volumes greater than 36,000 acre-feet was more than they would like to risk, they might plan on receiving 52,000 acre-feet (from the 30 percent chance of exceeding forecast) to minimize potential flooding problems. Three Out of ten years with similar conditions, streamflows will exceed the 52,000 acre-foot forecast.

In years when users expect extremely wet conditions for the remainder of the season and the threat of severe flooding and downstream damage exists, they might choose to use the 76,000 acre-foot (10 percent chance of exceeding) forecast for their water management operations. Streamflow volumes will exceed this level only one year out of ten.

WEISER, PAYETTE, BOISE RIVER BASINS
Streamflow Forecasts

Forecast Point	Forecast Period	<<===== Drier ====== Future Conditions ======= Wetter =====>> Chance Of Exceeding * 90% (1000AF)	70% (1000AF)	50% (Most Probable) (1000AF)	50% (Most Probable) (% AVG.)	30% (1000AF)	10% (1000AF)	30-Yr Avg. (1000AF)
SF PAYETTE RIVER at Lowman	APR-JUL	329	414	471	109	528	613	432
	APR-SEP	369	459	521	107	583	673	488
BOISE RIVER near Twin Springs (1)	APR-JUL	443	610	685	109	760	927	631
	APR-SEP	495	670	750	109	830	1005	

For more information concerning streamflow forecasting ask your local NRCS field office for a copy of "A Field *Office Guide* for *Interpreting Streamflow Forecasts" or visit our Web page.*

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